

Presentation of Specification to TSG or WG

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Agenda item:	8.7.5 Improvement of inter-frequency and inter-system measurement for 1.28 Mcps TDD
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Abstract of document:

This technical report is for the Release 6 study item “Improvement of inter-frequency and inter-system measurement for 1.28 Mcps TDD”. In this report, the changes in TR25.888 are described since the last TSG RAN meeting #17.

Changes since last presentation to TSG-RAN Meeting #17:

The new contents are included in section 6 of proposed methods:

- In section 6.1.1 Overview of proposed channel re-assigning method is described.
- In section 6.1.2 GSM measurement is described.
- In section 6.1.3 FDD measurement is described.
- In section 6.1.4 3.84Mcps TDD measurement is described.
- In section 6.1.5 1.28Mcps TDD measurement is described.
- In section 6.1.6.1 Impact on beam-forming is described.
- In section 6.1.6.2 Impact on DCA is described in case of code resource and power are available.

Outstanding Issues:

None

Contentious Issues:

None

**3rd Generation Partnership Project;
Technical Specification Group Radio Access Network;
Improvement of inter-frequency and inter-system
Measurement for 1.28Mcps TDD**

(Release 6)



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Foreword

This Technical Report(TR) has been produced by the 3rd Generation Partnership Project (3GPP), Technical Specification Group RAN.

The contents of this TR are subject to continuing work within the 3GPP TSG and may change following formal TSG approval. Should the TSG modify the contents of this TR, it will be re-released with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

1. Scope

In order to improve monitoring other RAT systems or performing inter-frequency measurements in 1.28 Mcps TDD , the channel re-assigning scheme with signaling support and other possible solutions are proposed and investigated, potentially allowing the UE to have a longer measurement window or to avoid possible measurement failures. The purpose of this document is to help the TSG RAN WG1, WG2, WG3 and WG4 to understand potential benefits with respect to the respective study areas, to investigate the proposed method and to identify the impacts to current specifications, which is needed for the introduction of the improvement of inter-frequency and inter-system measurement for 1.28 Mcps TDD.

The different study areas will be described in subsequent chapters.

It is intended to gather all information in order to trace the history and the status of the SI in each WGs.

The TR should:

- describe the proposed methods for each study area.
- describe the impacts due to this SI.
- describe agreed requirements related to the SI.
- identify the affected specifications according to the introduction of inter frequency and inter system measurement for 1.28 Mcps TDD and
- also describes the schedule of the SI.

2. References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.

For a specific reference, subsequent revisions do not apply.

For a non-specific reference, the latest version applies.

[1] 3GPP TS 25.123, "Requirements for Support of Radio Resources Management"

[2] 3GPP TS25.222, "Multiplexing and channel coding (TDD)"

[3] 3 GPP TS25.224, "Physical Layer Procedures (TDD)"

[4] 3GPP TS25.423, "UTRAN Iur Interface RNSAP Signalling"

[5] 3GPP TS25.433, "UTRAN Iub Interface NBAP Signalling"

[6] 3GPP TS 25.331, "RRC Protocol Specification".

3. Definitions, symbols and abbreviations

3.1. Definitions

For the purposes of the present document, the following terms and definitions apply.

3.2. Symbols

3.3. Abbreviations

4. Requirements

The general requirements of any proposed schemes are summarised as follows:

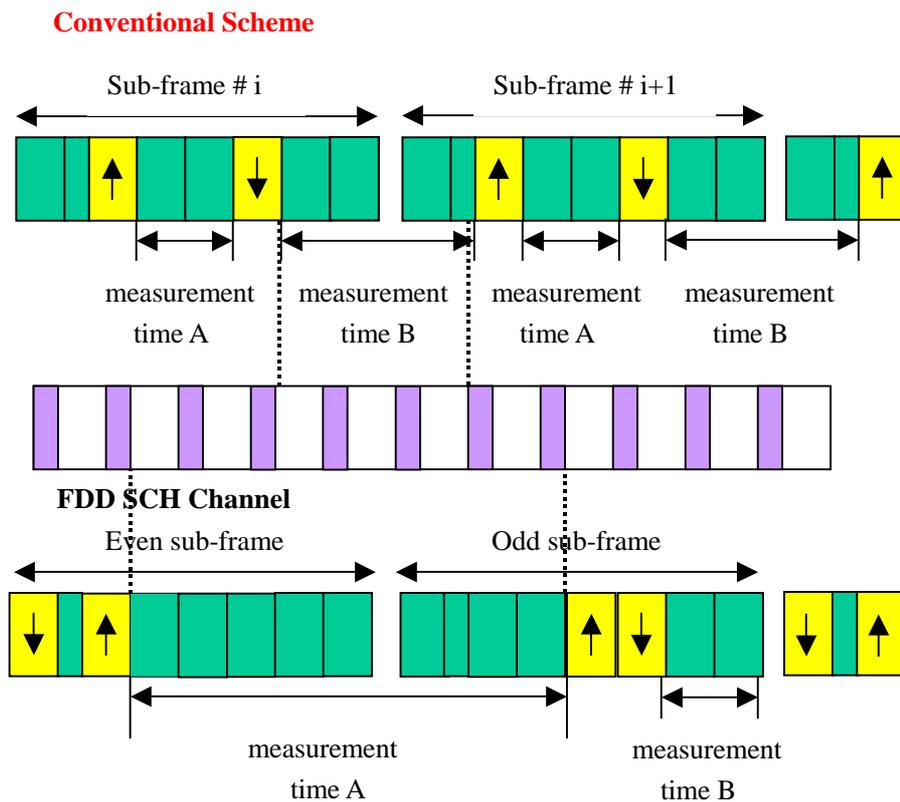
- Full backward compatibility with the previous release should be kept.
- The signalling overhead in the higher layers should be minimized.
- The proposed scheme must show a reasonable performance improvement.

5. Study Areas

5.1. Asymmetric pattern for time slot allocation

In current Rel-4 specification, some idle time slots without traffic can be used for inter-frequency or inter-system monitoring in 1.28 Mcps TDD. In the conventional scenarios, traffic channel allocation is symmetric, which means two sub-frames in one frame will use the same time slot allocation pattern. However, it can occur that the measurement window may be very short and result in relatively long synchronisation time or synchronisation failure. Especially in FDD case, only small number of consecutive SSCs can be acquired in one measurement window.

In order to synchronize with FDD when UE handover to FDD from 1.28Mcps TDD, 1.28Mcps TDD UE should monitor Primary SCH in order to get time slot timing, and monitor Secondary SCH of FDD to get frame timing. For Primary SCH, PSC with length of 256 chips is the same for every cell in the system and transmits once every slot. For Secondary SCH, it repeatedly transmits a sequence of 15 SSCs with length of 256 chips every frame. Figure1 give an example of traffic channels allocation in conventional scheme. Whenever we take traffic channel allocation in conventional scheme as described Figure 1, the measurement window may be so short that at most two consecutive SSCs can be acquired in one measurement window. Consequently, it may be possible that we can't get enough timing information for synchronization with FDD, and the probability of successful handover will be decreased greatly. Considering the best case of conventional scheme which means UL and DL are neighboring the second switching point, the measurement window length is 5 idle timeslots, and at most 4 consecutive SSCs can be acquired. During the procedure of measurement, all the possible traffic channel allocation should be considered.



Asymmetric scheme

Figure 1. Comparison of the measurement window length between symmetric and asymmetric time slot allocation pattern.

Therefore, in order to solve the addressed problems in conventional scheme, special kind of asymmetric pattern for time slot allocation in each 1.28Mcps TDD frame is proposed to get a longer measurement window. In asymmetric channel allocation pattern, channel allocation is different in two sub-frames of one frame. In one frame, the first sub-frame is called as even sub-frame, and the second sub-frame as odd sub-frame. In even sub-frame, downlink traffic channel is re-assigned to TS0, and uplink traffic channel is re-assigned to TS1; in odd sub-frame, downlink traffic channel is re-assigned to the timeslot just after the second switching point, and the uplink traffic channel to the timeslot just before the second switching time. So measurement can be carried out during all idle time slots except the pre-assigned traffic timeslots.

It can be seen from Figure 1 that asymmetric pattern for time slot allocation provides larger measurement window than conventional scheme. This is partially due to the reduction of number of RF frequency switching, hence the consideration for switching time in this study area is needed.

Considering the impact on other function, further investigations on the impact of power control, beam-forming, uplink synchronization, DCA, and the maximum number of traffic channels in TS0 which is also used for the P-CCPCH resulted from employing the asymmetric time slot allocation pattern are necessary in relation to this study item.

5.2. Combination of different time slot allocation pattern

In order to synchronize with 3.84Mcps TDD before handover to 3.84Mcps TDD from 1.28Mcps TDD, 1.28Mcps TDD UE needs to monitor Primary SCH and Secondary SCH of 3.84Mcps TDD. There are 2 cases of SCH and P-CCPCH allocation in 3.84 Mcps TDD: case 1; SCH and P-CCPCH allocated in TS #k, k=0,1,...,14; case 2; SCH allocated in two timeslots, TS #k and TS#k+8, k=0,1,...,6, and P-CCPCH allocated in TS #k. SCH consists of parallel of a primary and three secondary code sequences each 256 chips long.

In current Rel-4 specification, some idle time slots without traffic can be used for inter-frequency or inter-system measurement in 1.28 Mcps TDD. When 1.28 TDD UE monitors the 3.84Mcps TDD cell, SCH in 3.84Mcps TDD can't be acquired in current measurement window in 1.28Mcps TDD whenever the traffic channel in 1.28 Mcps TDD is aligned with SCH in the 3.84 Mcps TDD. Refer to Figure 2 and Figure 3 which exist problems during 1.28Mcps TDD

UE synchronisation with 3.84Mcps TDD cell in case 1 and case 2 respectively. Even if the traffic channel in 1.28Mcps TDD may change, there is still the probability of not being able to acquire SCH in 3.84 Mcps TDD, this probability depends on the location to which traffic channels change.

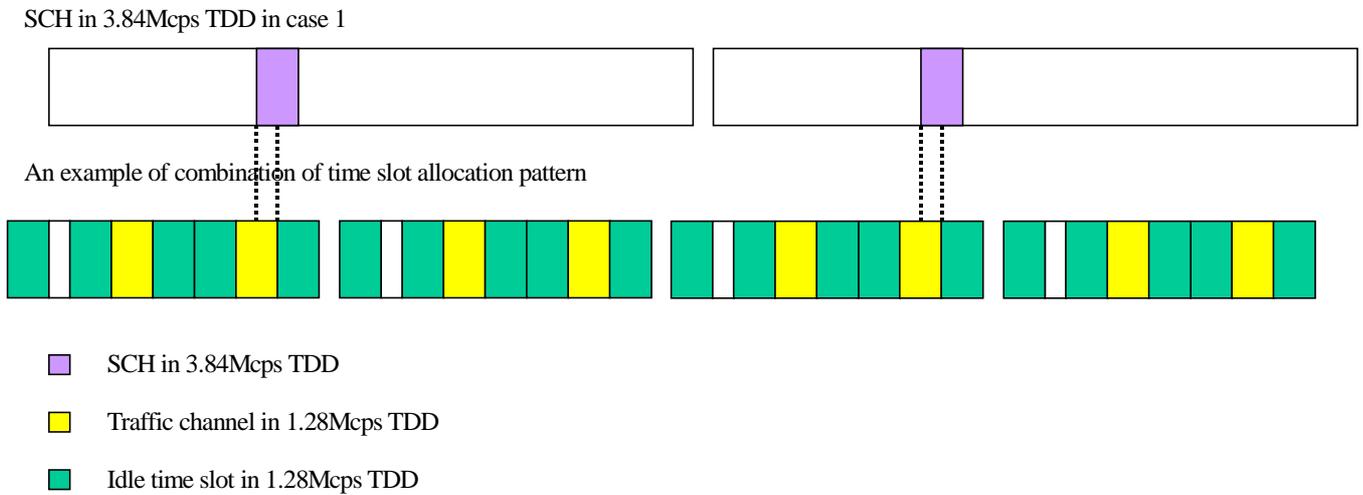


Figure 2. Problem identification in case 1 when 1.28Mcps TDD UE monitoring 3.84Mcps TDD cell

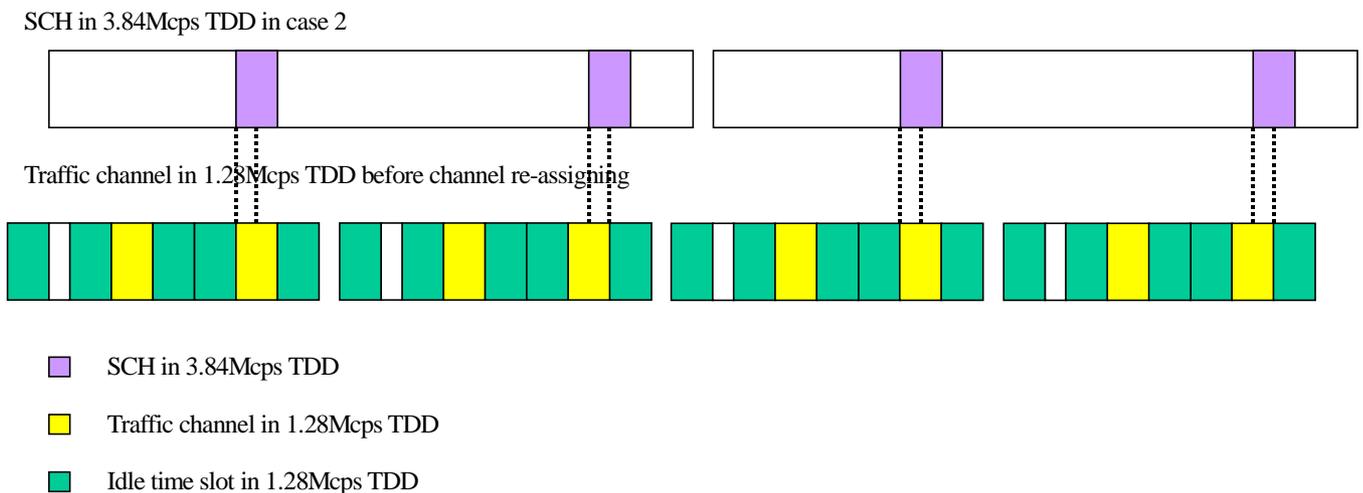


Figure 3. Problem identification in case 2 when 1.28Mcps TDD UE monitoring 3.84Mcps TDD cell

Therefore, in order to solve the addressed problems in conventional scheme, combination of different time slot allocation pattern is proposed to change traffic time slots according to some kind of predefined time slot allocation pattern in order to guarantee the higher or perfect (100%) probability of acquiring SCH in 3.84Mcps TDD.

Combination of different time slot allocation pattern means that traffic channels is re-assigned according to some predefined time slot allocation frame by frame periodically like this:

1st frame: pattern # A

2nd frame: pattern # B

3rd frame: pattern # A

4th frame: pattern #B

This cycle repeats periodically

Here pattern #A or pattern #B refers to one kind of traffic time slot allocation in one frame.

Figure 4 is an example of such combination of different time slot allocation pattern. Pattern #A is configured as TS3 for UL, TS4 for DL;

Pattern #B is configured as TS1 for UL, TS6 for DL;

That means:

1st frame: TS3 for UL, TS4 for DL

2nd frame: TS1 for UL, TS6 for DL

3rd frame: TS3 for UL, TS4 for DL

4th frame: TS1 for UL, TS6 for DL

This cycle repeats periodically...
 All idle time slots without traffic can be used for measurement.

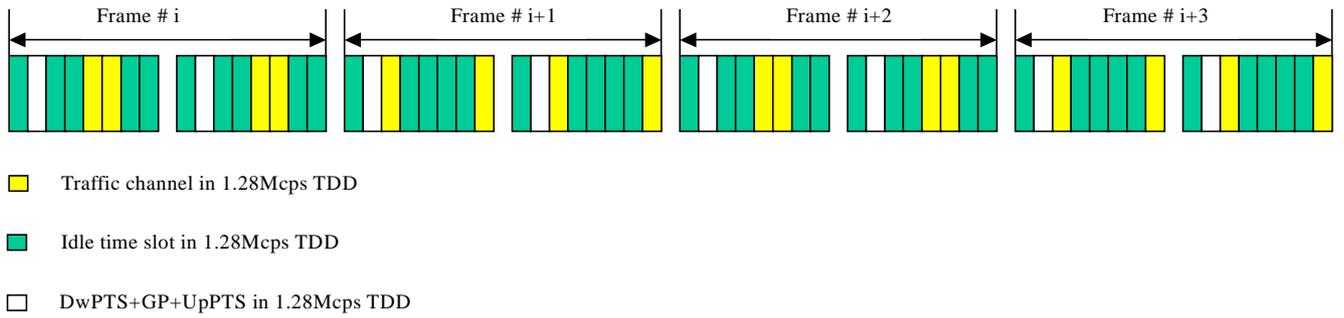


Figure 4 aAn example of combination of different time slot allocation pattern

Figure 5 and figure 6 give an example to illustrate the necessity of using the combination of time slot allocation pattern, and it also provides preventing the measurement failure during synchronization procedure.

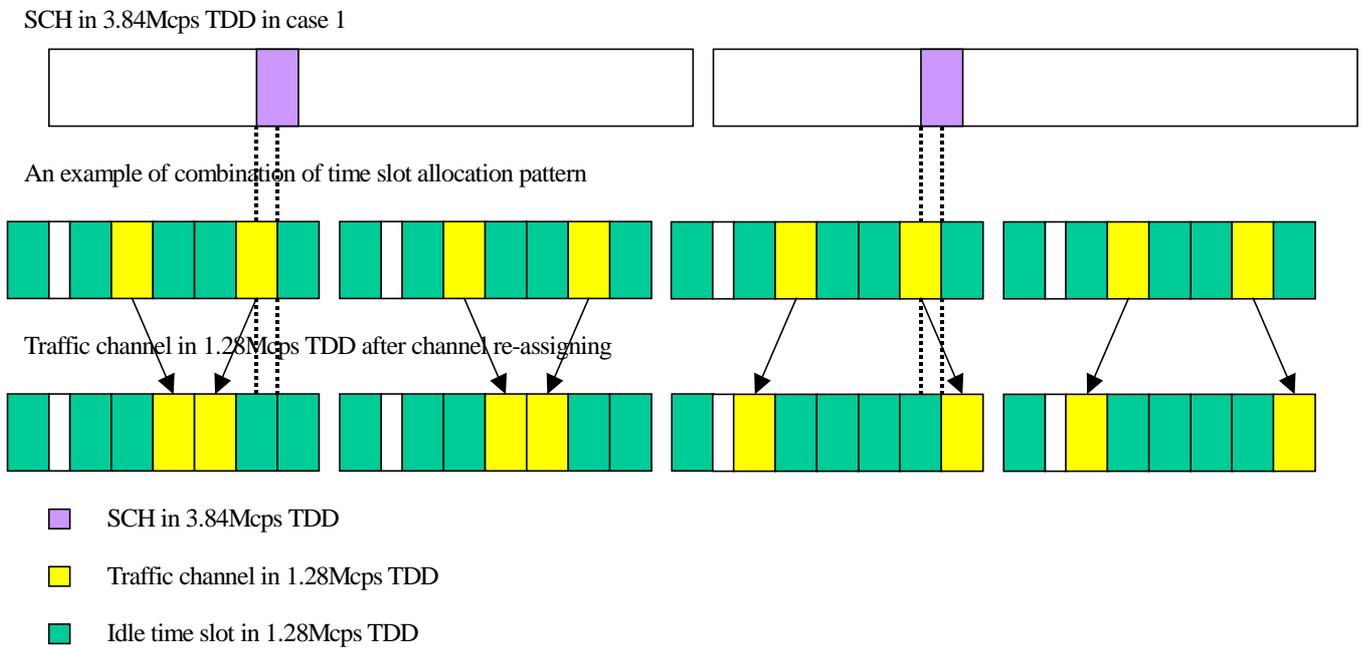


Figure 5. Comparison of monitoring SCH in 3.84Mcps TDD by using combination of time slot allocation pattern and conventional scheme in case 1

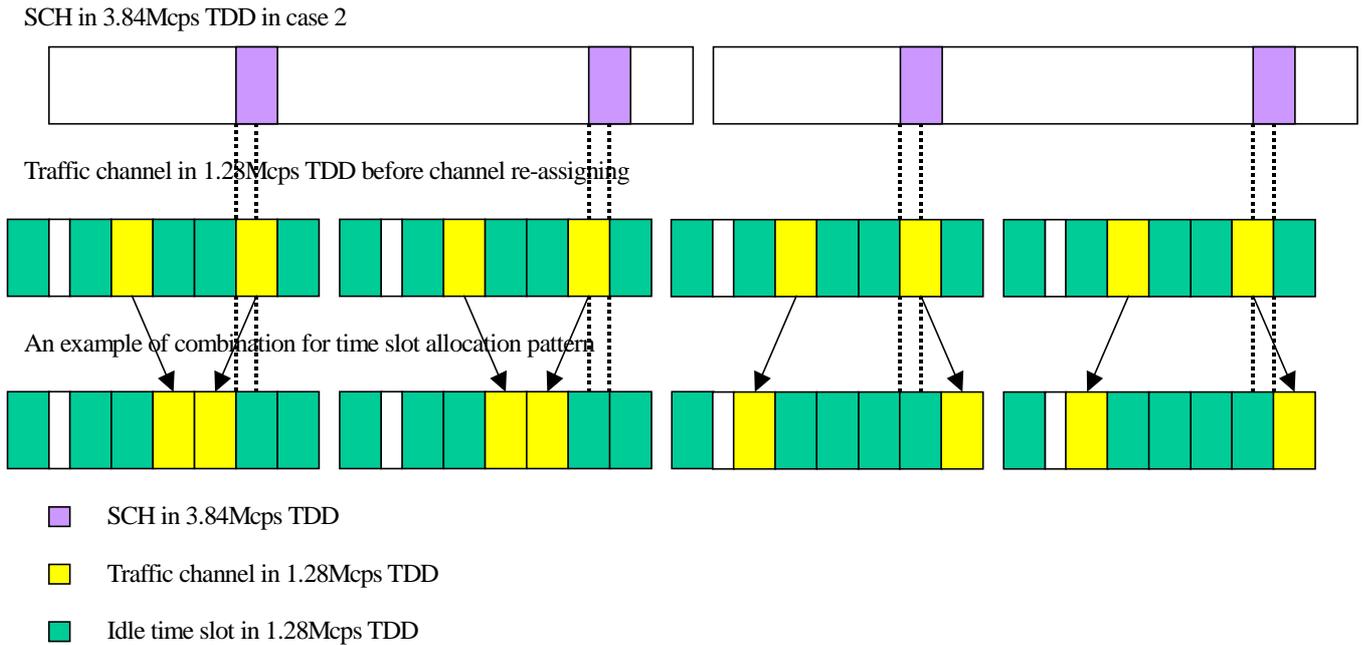


Figure 6. Comparison of monitoring SCH in 3.84Mcps TDD by using combination of time slot allocation pattern and conventional scheme in case 2

In order to resolve the addressed problems, it is necessary to study the combination method of different time slot allocation pattern in which traffic time slots can change according to some kind of predefined time slot allocation pattern in order to guarantee the higher or perfect (100%) probability of acquiring SCH in 3.84Mcps TDD.

Considering the impact on other functions of 1.28 Mcps TDD, further investigation of the impact on the power control, beam-forming, uplink synchronisation and DCA etc. by employing proposed combination method is also necessary in relation to this SI.

6. Proposed methods

6.1. Channel reassigning method

6.1.1 Overview of proposed channel re-assigning method

In FDD mode, compressed mode is used for inter-frequency and inter-system measurements, since the transmission in the physical channels in FDD are continuous. But for 1.28Mcps TDD, the transmissions are discontinuous, so some idle time slots which have no traffic can be used for inter-frequency and inter-system measurement.

A channel re-assigning procedure before starting inter-frequency and inter-system measurement is proposed to enlarge measurement window length or change the position of measurement window in order to reduce synchronisation time and increase the probability of successful synchronisation. Channel re-assigning method means that traffic time slots assigned for uplink and downlink can be reallocated before inter-frequency and inter-system measurement.

In section 5 – Study Area, asymmetric pattern and pattern combination scheme are introduced as two channel re-assigning methods.

6.1.2 GSM measurement

During GSM measurement, synchronisation with GSM will be performed in order to verify BSIC.

Here we consider synchronize with FCCH and FCCH+SCH both by conventional scheme and by asymmetric pattern.

6.1.2.1 Asymmetric pattern applying for GSM measurement

In conventional scheme, idle time slots which have no traffic is proposed to be used for inter-frequency and inter-

system measurement. In order to reduce synchronisation time or avoid synchronisation failure case with low cost terminal, asymmetric pattern can be used for GSM measurement. Comparison of asymmetric pattern and conventional scheme during synchronisation with FCCH and FCCH+SCH are shown in Table 1. Simulation assumptions refer to Annex A.

Table1. Comparison of asymmetric pattern and conventional scheme during GSM measurement

	0.5ms switching time			0.8ms switching time (This has not been decided by RAN4 yet)		
	Asymmetric pattern	Conventional scheme	Special case in conventional scheme*	Asymmetric pattern	Conventional scheme	Special case in conventional scheme
Average sync time with FCCH (ms)	65.7	167.2	75.6	77.8	Measurement failure probability* *: 41.9%	95.1
Average sync time with FCCH+SCH (ms)	136.2	272.6	92.5	162.2		114.2
Max sync time with FCCH (ms)	184.2	656.5	187.2	274.5		232.5
Max sync time with FCCH+SCH (ms)	234.9	896.5	237.2	514.5		237.5
Min sync time with FCCH (ms)	1.1	1.1	1.1	1.4		1.4
Min sync time with FCCH+SCH (ms)	51.8	6.1	6.1	52.1		6.3

*Note: Conventional scheme in Table 1 considers all possible traffic channel allocation. Special case in conventional scheme means one of the special traffic channel allocation which produces the best performance in conventional scheme. This corresponds to the case that TS3 for UL and TS4 for DL is allocated every sub-frame.

** Measurement failure criterion is according to the requirement in TS25.123. $T_{\text{identify abort}} = [5000]$ ms.

In case of GSM measurement scenarios, when switching time is 0.5ms, proposed asymmetric pattern scheme can achieve the reduction of synchronization time than conventional scheme, but the special case in conventional scheme attains less synchronisation time than asymmetric pattern. And for low cost terminal with 0.8ms switching time, the use of asymmetric pattern can avoid synchronisation failure case compared to the conventional scheme. However, further study on both asymmetric pattern scheme and special case is needed, such as impact on power control, beamforming, UL synchronisation and DCA.

6.1.2.2 Pattern Combination Scheme applying for GSM measurement

Comparison of pattern comparison scheme and conventional scheme during synchronisation with FCCH and FCCH+SCH are shown in Table 2.

Table 2. Comparison of pattern combination scheme and conventional scheme during GSM measurement

	0.5ms switching time			0.8ms switching time (This has not been decided by RAN4 yet.)		
	Pattern combination scheme	Conventional scheme	Special case in conventional scheme*	Pattern combination scheme	Conventional scheme	Special case in conventional scheme*

Average sync time with FCCH (ms)	112.1	167.2	75.6	measurement failure probability** : 4.2%	measurement failure probability: 41.9%	95.1
Average sync time with FCCH+SCH (ms)	232.5	272.6	92.5			114.2
Max sync time with FCCH (ms)	506.6	656.5	187.2			232.5
Max sync time with FCCH+SCH (ms)	746.6	896.5	237.2			237.5
Min sync time with FCCH (ms)	1.1	1.1	1.1			1.4
Min sync time with FCCH+SCH (ms)	6.1	6.1	6.1			6.3

*Note: Conventional scheme in Table 2 considers all possible traffic channel allocation. The best case in conventional scheme means one of the special traffic channel allocation in conventional scheme which is TS3 for UL and TS4 for DL every sub-frame.

** Measurement failure criterion is according to the requirement in TS 25.123. $T_{\text{identify abort}} = [5000]$ ms.

The table shows that pattern combination scheme has less synchronisation time than conventional scheme when considering all the possible traffic channel allocation and pattern combination scheme has longer synchronisation time than special case of traffic channel allocation in conventional scheme. After comparing the simulation results with those of asymmetric pattern, the performance of pattern combination scheme is worse than that of asymmetric pattern scheme in the case of GSM measurement.

6.1.3 FDD measurement

During FDD measurement, 1.28Mcps TDD UE should synchronize with FDD Primary SCH and Secondary SCH.

6.1.3.1 Asymmetric pattern applying for FDD measurement

In section 5, FDD measurement is described as an example of asymmetric pattern application. In this section simulation results of monitoring Primary SCH and Secondary SCH by using asymmetric pattern and conventional scheme are given in order to make comparison. Simulation assumptions refer to Annex A. Simulation results of synchronisation with primary SCH or secondary SCH by using conventional scheme and asymmetric pattern are shown in Table 3.

Table 3. Comparison of synchronisation time of monitoring Primary SCH or Secondary SCH by using asymmetric pattern and conventional scheme

	Average Sync time (ms)			Max Sync time (ms)			Min Sync time (ms)		
	Asymmetric pattern	Conventional scheme	Special case in conventional scheme*	Asymmetric pattern	Conventional scheme	Special case in conventional scheme	Asymmetric pattern	Conventional scheme	Special case in conventional scheme
Acquiring 75PSCs or 75SSCs	106.1	149.4	96.6	124.1	248.6	107.9	104.1	107.2	92.6
Acquiring 150PSCs or 150SSCs	217.0	299.7	194.1	244.1	498.6	212.9	214.1	212.2	187.6
Acquiring 225PSCs or 225SSCs	328.8	451.2	292.8	374.1	748.6	322.9	324.1	322.2	282.6

*Note: Conventional scheme in Table 3 considers all possible traffic channel allocation. Special case in conventional scheme means one of the special traffic channel allocation which produces the best performance in conventional

scheme. This corresponds to the case that TS3 for UL and TS4 for DL is allocated every sub-frame.

In case of FDD measurement scenarios, proposed asymmetric pattern scheme can achieve the reduction of synchronization time than conventional scheme, but the special case in conventional scheme attains less synchronisation time than asymmetric pattern. However, further study on both asymmetric pattern scheme and special case is needed, such as impact on power control, beamforming, UL synchronisation and DCA.

6.1.3.2 Pattern Combination Scheme applying for FDD measurement

In this section, pattern combination scheme applies for FDD measurement to see the performance. Simulation results of monitoring Primary SCH and Secondary SCH by using pattern combination scheme and conventional scheme are given in order to make comparison.

Simulation results of synchronisation with primary SCH or secondary SCH by using pattern combination scheme and conventional scheme are shown in Table 4.

Table 4. Synchronisation time of monitoring Primary SCH or Secondary SCH by using pattern combination scheme and conventional scheme

	Average Sync time (ms)			Max Sync time (ms)			Min Sync time (ms)		
	Pattern Combination scheme	Conventional scheme	Special case in conventional scheme*	Pattern Combination scheme	Conventional scheme	Special case in conventional scheme	Pattern Combination scheme	Conventional scheme	Special case in conventional scheme
Acquiring 75PSCs or 75SSCs	119.9	149.4	96.6	146.2	248.6	107.9	114.6	107.2	92.6
Acquiring 150PSCs or 150SSCs	240.7	299.7	194.1	297.5	498.6	212.9	229.6	212.2	187.6
Acquiring 225PSCs or 225SSCs	360.0	451.2	292.8	446.2	748.6	322.9	342.6	322.2	282.6

*Note: Conventional scheme in Table 4 considers all possible traffic channel allocation. Special case in conventional scheme means one of the special traffic channel allocation in conventional scheme, which allocate TS3 for UL and TS4 for DL every sub-frame.

This table shows that pattern combination scheme has less synchronisation time than conventional scheme when considering all the possible traffic channel allocation, and pattern combination scheme has longer synchronisation time than special case of traffic channel allocation in conventional scheme. However, compared with the simulation results of asymmetric pattern, the performance of pattern combination scheme is worse than that of asymmetric pattern scheme in the case of FDD measurement.

6.1.4 3.84Mcps TDD measurement

During 3.84Mcps TDD measurement, 1.28Mcps TDD UE should synchronize with 3.84Mcps TDD Primary SCH and Secondary SCH. Problem identification of 3.84Mcps TDD measurement from 1.28Mcps TDD in conventional scheme is described in section 5.2.

6.1.4.1 Asymmetric pattern applying for 3.84Mcps TDD measurement

Asymmetric pattern described in section 5.1 can be used to solve the problem addressed in the conventional scheme. Simulation results of monitoring 3.84Mcps TDD by using asymmetric pattern and conventional scheme are given in Table 5. Case 2 of 3.84Mcps TDD SCH is considered. Simulation assumptions refer to Annex A.

Table 5. Simulation results comparison by using asymmetric pattern and conventional scheme with different switching time in 3.84Mcps TDD SCH case 2

Switching time	Successful sync probability by using asymmetric pattern	Successful sync probability in conventional scheme	Successful sync probability of special case in conventional scheme
0.2ms	98.75%	62.92%	70.34%
0.3ms	96.72%	56.79%	66.43%
0.4ms	94.47%	50.78%	62.37%
0.5ms	92.12%	44.50%	58.31%

From the above table, it can be seen that in case of 3.84 Mcps TDD measurement scenario, asymmetric pattern can greatly increase the successful synchronisation probability compared with conventional scheme and special case during 3.84Mcps TDD measurement. Even when synthesizer switching time is 0.5ms, the probability of successful synchronisation is more than 90%.

6.1.4.2 Pattern Combination Scheme applying for 3.84 Mcps TDD measurement

Pattern combination scheme can be used to solve the problem addressed in the conventional scheme during 3.84Mcps TDD measurement. Simulation results of monitoring 3.84 Mcps TDD by using pattern combination scheme and conventional scheme are given in Table 6. Case 2 of 3.84Mcps TDD SCH is considered.

Table 6. Simulation results comparison by using pattern combination scheme and conventional scheme with different switching time in 3.84Mcps TDD SCH case 2

Switching time	Successful sync probability by using pattern combination scheme	Successful sync probability in conventional scheme	Successful sync probability of special case in conventional scheme
0.2ms	100%	62.92%	70.34%
0.3ms	100%	56.79%	66.43%
0.4ms	100%	50.78%	62.37%
0.5ms	97.50%	44.50%	58.31%

From the above table, it is observed that the probability of successful synchronisation with SCH in conventional scheme is around 40 ~ 60 %, which is not a satisfactory reliability of the synchronization performance, even 0.2ms switching time is allowed. Pattern combination scheme can greatly increase the successful synchronisation probability compared with conventional schemes and special case during 3.84Mcps TDD. It nearly attains 100 % (perfect) synchronization probability when synthesizer switching time is no more than 0.4ms. Comparing the simulation results with those of asymmetric pattern, similar performance is achieved in case of 3.84 Mcps TDD measurement.

6.1.5 1.28Mcps TDD measurement

In order to synchronize with 1.28Mcps TDD of different frequency before inter-frequency handover, original 1.28Mcps TDD cell needs to monitor DwPCH in target 1.28Mcps TDD cell with different frequency. The similar problem may occur during 1.28Mcps TDD measurement as that in 3.84Mcps TDD measurement, when the case of traffic channels in original cell in 1.28Mcps TDD overlapping with DwPCH in target cell occurs.

6.1.5.1 Asymmetric pattern applying for 1.28Mcps TDD measurement

Asymmetric pattern described in section 5.1 can be used to solve the problem addressed in the conventional scheme. Simulation results of monitoring 1.28Mcps TDD by using asymmetric pattern and conventional scheme are given in Table 7. Simulation assumptions refer to Annex A.

Table 7. Simulation results comparison by using asymmetric pattern and conventional scheme with different switching time

Switching time	Successful sync probability by using asymmetric pattern	Successful sync probability in conventional scheme	Successful sync probability in special case in conventional scheme
0.2ms	100%	53.20%	63.93%
0.3ms	100%	47.38%	59.88%
0.4ms	96.57%	41.33%	56.13%
0.5ms	92.51%	35.28%	52.07%

From the above table, it can be seen that asymmetric pattern can greatly increase the successful synchronisation

probability compared with conventional scheme and special case during 1.28Mcps TDD measurement, even can reach 100% when switching time is no more than 0.3ms.

6.1.5.2 Pattern Combination Scheme applying for 1.28 Mcps TDD measurement

Pattern combination scheme can be used to solve the problem addressed for 1.28 Mcps TDD measurement in the conventional scheme. Simulation results of monitoring 1.28 Mcps TDD by using pattern combination scheme and conventional scheme are given in Table 8.

Table 8. Simulation results comparison by using pattern combination scheme and conventional scheme with different switching time

Switching time	Successful sync probability by using pattern combination scheme	Successful sync probability in conventional scheme	Successful sync probability in special case in conventional scheme
0.2ms	100%	53.20%	63.93%
0.3ms	100%	47.38%	59.88%
0.4ms	93.13%	41.33%	56.13%
0.5ms	85.01%	35.28%	52.07%

From the above table, it is observed that the probability of successful synchronisation with SCH in conventional scheme is around 30 ~ 50 %, which is not a satisfactory reliability of the synchronization performance, even though 0.2ms switching time is allowed. Pattern combination scheme can also greatly increase the probability of successful synchronisation compared with conventional scheme and special case during 1.28Mcps TDD measurement. It also attains 100%(perfect) synchronization probability when synthesizer switching time is no more than 0.3ms. Comparing the simulation results with those of asymmetric pattern, similar performance is achieved in case of 1.28 Mcps TDD measurement.

6.1.6 Impacts on other function

6.1.6.1 Impact on beam-forming

Figure 7-13 show different beam-forming schemes for conventional scheme, special case in conventional scheme, asymmetric pattern and pattern combination scheme. Beam-forming scheme 1 for special case in conventional scheme, asymmetric pattern and pattern combination scheme can be used when the speed of the hardware of Node B is fast enough to complete the estimation and generating antenna weight before the neighboring downlink channel transmits. While beam-forming scheme 2 in these three schemes can be used when the beam-forming algorithm is complex and the speed of the hardware of Node B is not fast enough.

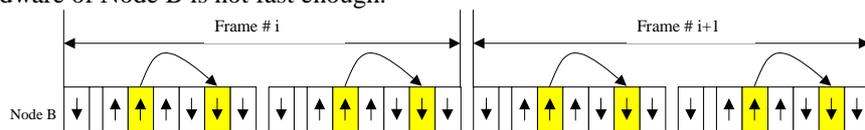


Figure 7. Beam-forming in conventional scheme in 1.28Mcps TDD

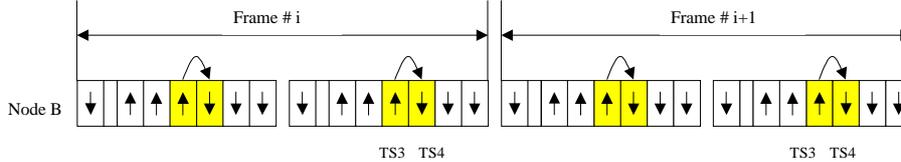


Figure 8. Beam-forming scheme 1 in "special case in conventional scheme" in 1.28Mcps TDD

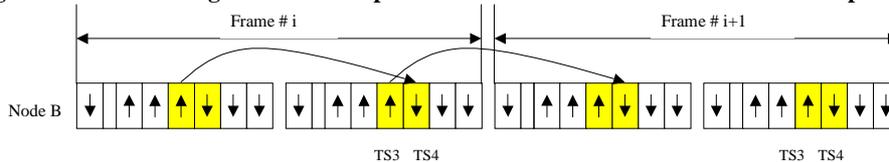


Figure 9. Beam-forming scheme 2 in "special case in conventional scheme" in 1.28Mcps TDD

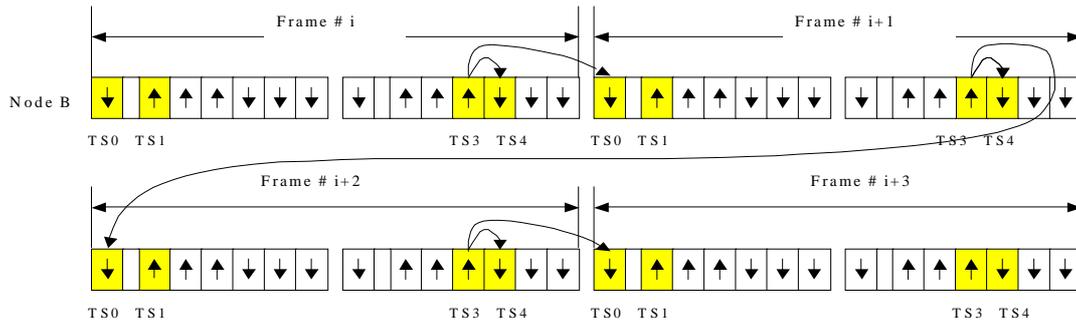


Figure 10. Beam-forming scheme 1 for asymmetric pattern in 1.28Mcps TDD

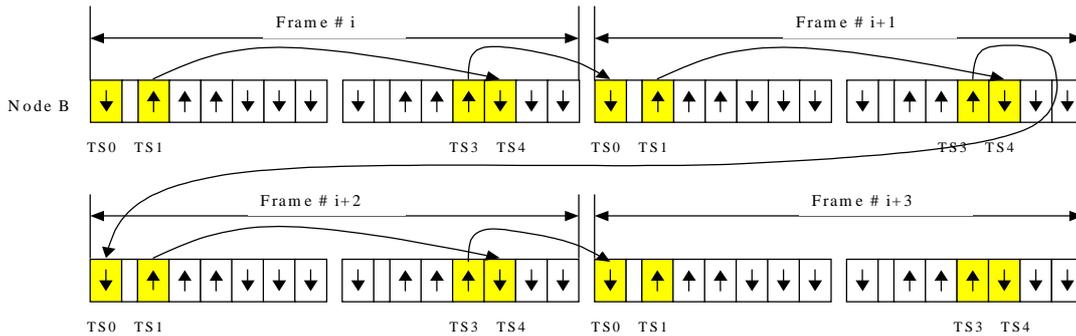


Figure 11. Beam-forming scheme 2 for asymmetric pattern in 1.28Mcps TDD

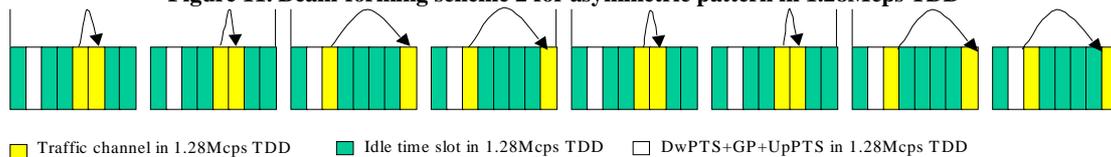


Figure 12. Beam-forming scheme 1 for pattern combination scheme in 1.28Mcps TDD

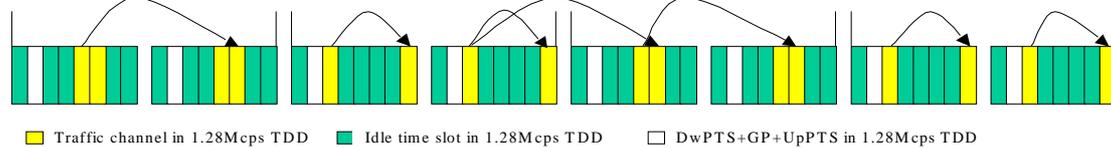


Figure 13. Beam-forming scheme 2 for pattern combination scheme in 1.28Mcps TDD

Table 9 gives comparison of beam-forming rate and delay in different schemes.

Table 9. Comparison of beam-forming rate and delay by using different schemes.

	Conventional scheme	Special case in conventional scheme		Asymmetric pattern		Pattern combination scheme	
		Scheme 1	Scheme 2	Scheme 1	Scheme 2	Scheme 1	Scheme 2
Beam-forming rate	200Hz	200Hz	200Hz	200Hz	200Hz	200Hz	200Hz
Beam-forming delay	In one sub-frame	In one sub-frame	One frame	In one sub-frame	In one sub-frame	In one sub-frame	In one frame

Beam-forming scheme 1 for asymmetric pattern, pattern combination scheme, and special case in conventional scheme have no impact on beam-forming. And beam-forming scheme 2 for these 3 schemes has no more than one sub-frame delay of beam-forming compared with scheme 1, and will cause little impact on beam-forming.

6.1.6.2 Impact on DCA

The purpose of DCA is, on one side, the limitation of the interference (keeping required QoS) and on the other side, to maximise the system capacity due to minimising the reuse distance. Therefore, DCA algorithm performs the channel

reallocation based on the interference measurement report in order to maximize the system capacity. However, the purpose of channel reallocation for inter-RAT measurement is to enlarge the measurement window, which is the somewhat different criteria compared with the channel reallocation in DCA. Hence, the impact on DCA depends on the frequency and duration of inter-RAT measurement occurrence and also the frequency of DCA operation and update period. However, detailed DCA procedure is not exactly specified in the current specification, it also means that a lot of flexibility can be provided to implement DCA procedure in order to reduce the impact on it. Hence the impact on DCA will be little because we can modify the DCA initiation and operation procedure not to interfere the inter-RAT measurement procedure which occurs from time to time, not very often. The conclusion applies if codes are already available or some codes are reserved for inter-RAT measurement and the power is available.

6.2. Other methods

7. Impacts on TSG RAN Specifications

7.1. WG1

7.2. WG2

7.3. WG3

7.4. WG4

8. Agreements and associated contributions

9. Backward Compatibility

Annex A. Simulation Assumptions of monitoring GSM/FDD/3.84Mcps TDD/1.28Mcps TDD

- Timing information with GSM/FDD/3.84Mcps TDD/1.28Mcps TDD is not known before monitoring.
- Timing alignment between GSM/FDD/3.84Mcps TDD/1.28Mcps TDD and 1.28Mcps TDD is random, and obeys uniform distribution.
- Step size of timing alignment is 10chips of 1.28Mcps TDD.
- Low data rate traffic with only 1 uplink and 1 downlink is considered.
- 3 uplink time slots (TS1, TS2, TS3) and 4 downlink time slots (TS0, TS4, TS5, TS6) channel structure in one sub-frame are assumed in the simulation.
- In 1.28Mcps TDD, TS1 is fixed for uplink traffic, and the probability of downlink channel allocation in TS4, TS5, TS6 and TS0 is equal.
- Monitoring channel in different purposes:
 - > During GSM measurement, two cases of monitoring scheme are considered. One is acquiring a complete FCCH burst and the other is a complete FCCH burst and SCH burst together.
 - > During FDD measurement, First, Primary SCH is monitored. Synchronisation is considered successful when 75 SSCs, 150 SSCs, or 225 SSCs are acquired. Secondary SCH will be monitored after synchronisation with Primary

SCH is successful.

> During 3.84Mcps TDD measurement, First, Primary SCH is monitored. Second, Secondary SCH will be monitored after synchronization with Primary SCH is successful. Synchronisation with SCH is considered successful when both synchronization with Primary SCH and Secondary SCH are successful.

> During 1.28Mcps TDD measurement, DwPTS of 1.28Mcps TDD is considered for measurement.

Annex B Project Plan

B.1 Schedule

Date	Meeting	Scope	[expected] Input	[expected]Output
2003.03	RAN#19	TR Submission		V5.0.0

B.2 Work task Status

	Planned Date	Milestone	Status

Annex C History

Document history							
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New
2001.11	RAN 1 #22	R1-01-1317			Draft TR submitted to RAN#14		0.0.1
2002.01	RAN 1#23	R1-02-0121			Correction based on comments from RAN14	0.0.1	0.0.2
2002.02	RAN 1#24	R1-02-0468			Revised draft TR structure and scope	0.0.2	0.0.3
2002.05	RAN1#26	R1-02-0516			TR structure revised and scope updated. Document was approved.	0.0.3	0.1.0
2002.08	RAN1#28	R1-02-1059			mail approval of study area	0.1.0	1.0.0
2002.11	RAN1#29	R1-02-1442			pdate TR25.888	1.0.0	1.1.0
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